AMENDMENTS TO THE CLAIMS

Amendments to the claims:

This listing of claims will replace all prior versions, and listings, of claims in the specification:

Listing of the claims:

1. (Currently amended) A method of controlling path length in a quantum cryptographic key distribution (QKD) system, comprising:

receiving a signal identifying a plurality of symbols as training symbols over a QKD path;

receiving the plurality of training symbols transmitted from a QKD transmitter over [[a]] the QKD path via quantum cryptographic mechanisms; and

controlling a length of the QKD path based on the received plurality of training symbols.

2. (Original) The method of claim 1, further comprising:

estimating a phase error associated with transmission of the training symbols over the QKD path.

3. (Currently amended) The method of claim 2, ~~wherein~~ where estimating the phase error comprises:

determining probabilities of detection events associated with the received training symbols.

4. (Currently amended) The method of claim 3, ~~wherein~~ where estimating the phase error comprises:

estimating the phase error based on the determined probabilities.

5. (Original) The method of claim 2, further comprising:

controlling the length of the QKD path based on the estimated phase error.

6. (Original) The method of claim 4, further comprising:

controlling the length of the QKD path based on the estimated phase error.

7. (Currently amended) The method of claim 4, ~~wherein~~ where estimating the phase error comprises:

performing a least squares estimation of the phase error using the determined probabilities.

8. (Currently amended) The method of claim [[2]] 1, ~~wherein~~ where estimating the phase error comprises:

employing at least one Kalman filter to estimate the phase error.

9. (Currently amended) The method of claim 4, ~~wherein~~ where estimating the phase error comprises:

performing a robust least squares estimation of the phase error using the determined probabilities.

10. (Currently amended) The method of claim 9, ~~wherein~~ where the robust least squares estimation comprises at least one of least absolute residuals and Bisquare weights.

11. (Currently amended) A system [[for]] configured to automatically initialize ~~initializing~~ a length of a quantum cryptographic key distribution (QKD) path in a QKD system, comprising:

a QKD receiver configured to determine whether training symbols are to be received and to receive training symbols from a QKD transmitter over the QKD path;

a phase shifting element disposed on the QKD path; and

processing logic configured to automatically initialize the length of the QKD path, using the phase shifting element, based on the received training symbols.

12. (Currently amended) A computer-readable ~~medium~~ memory device containing instructions [[for]] configured to control ~~controlling~~ at least one processor to perform a method of controlling path length in a quantum cryptographic key distribution (QKD) system, the method comprising:

receiving a signal identifying a plurality of symbols as training symbols over a QKD path;

receiving the plurality of training symbols transmitted from a QKD transmitter over [[a]] the QKD path via quantum cryptographic mechanisms; and

controlling a length of the QKD path based on the plurality of received symbols.

13. (Currently amended) A method of automatically controlling a path length in a quantum cryptographic key distribution system, the path comprising a first interferometer and a second interferometer, the method comprising:

employing a phase shifting element in the second interferometer; and

automatically adjusting the phase shifting element to control the path length based on training symbols transmitted over the path via quantum cryptographic mechanisms, where the training symbols were distinguished from other types of symbols transmitted over the path.

14. (Currently amended) The method of claim 13, ~~wherein~~ where the phase shifting element comprises a fiber stretcher.

15. (Currently amended) The method of claim 14, ~~wherein~~ where automatically adjusting the phase shifting element comprises:

adjusting a voltage applied to the fiber stretcher based on the symbols transmitted over the path.

16. (Currently amended) The method of claim 13, ~~wherein~~ where the phase shifting element comprises a phase modulator.

17. (Currently amended) The method of claim 16, ~~wherein~~ where automatically adjusting the phase shifting element comprises:

adjusting a voltage applied to the phase modulator based on the training symbols transmitted over the path.

18. (Original) The method of claim 13, further comprising:

estimating a phase error associated with symbols transmitted over the path.

19. (Currently amended) The method of claim 18, ~~wherein~~ where estimating the phase error comprises:

determining probabilities of detection events associated with the symbols transmitted over the path.

20. (Currently amended) The method of claim 19, ~~wherein~~ where estimating the phase error comprises:

estimating the phase error based on the determined probabilities.

21. (Currently amended) The method of claim 18, ~~wherein~~ where the phase shifting element is automatically adjusted to control the path length further based on the estimated phase error.

22. (Currently amended) The method of claim 20, ~~wherein~~ where estimating the phase error comprises:

performing a least squares estimation of the phase error using the determined probabilities.

23. (Currently amended) The method of claim 18, ~~wherein~~ where estimating the phase error comprises:

employing at least one Kalman filter to estimate the phase error.

24. (Currently amended) The method of claim 20, ~~wherein~~ where estimating the phase error comprises:

performing a robust least squares estimation of the phase error using the determined probabilities.

25. (Currently amended) The method of claim 24, ~~wherein~~ where the robust least squares estimation comprises at least one of least absolute residuals and Bisquare weights.

26. (Currently amended) A system [[for]] configured to automatically control ~~controlling~~ a path length in a quantum cryptographic key distribution (QKD) system, comprising:

a QKD path including a first interferometer and a second interferometer;

a phase shifting element disposed in at least one of the first and second interferometers; and

processing logic configured to automatically adjust the phase shifting element to control a length of the path based on training symbols transmitted over the QKD path via quantum cryptographic mechanisms, where the training symbols were distinguished from other types of symbols transmitted over the path.

27. (Currently amended) A method of automatically controlling a path length in a quantum cryptographic key distribution (QKD) system, comprising:

employing a feedback system in the QKD system, where the QKD system comprises a first interferometer and a second interferometer;

receiving training symbols transmitted over the path from the first interferometer to the second interferometer via quantum cryptographic mechanisms, where the training symbols are distinguished from data symbols; and

automatically controlling the path length, using the feedback system, based on the training symbols transmitted over the path from the first interferometer to the second interferometer.

28. (Currently amended) The method of claim 27, ~~wherein~~ where the feedback system comprises a phase shifting element.

29. (Currently amended) The method of claim 28, ~~wherein~~ where the phase shifting element comprises a fiber stretcher.

30. (Currently amended) The method of claim 29, ~~wherein~~ where automatically controlling the path length comprises:

adjusting a voltage applied to the fiber stretcher based on the training symbols transmitted over the path.

31. (Currently amended) The method of claim 28, ~~wherein~~ where the phase shifting element comprises a phase modulator.

32. (Currently amended) The method of claim 31, ~~wherein~~ where automatically controlling the path length comprises:

adjusting a voltage applied to the phase modulator based on the training symbols transmitted over the path.

33. (Original) The method of claim 27, further comprising:

estimating a phase error associated with symbols transmitted over the path.

34. (Currently amended) The method of claim 33, ~~wherein~~ where estimating the phase error comprises:

determining probabilities of detection events associated with the symbols transmitted over the path.

35. (Currently amended) The method of claim 34, ~~wherein~~ where estimating the phase error comprises:

estimating the phase error based on the determined probabilities.

36. (Currently amended) The method of claim 33, ~~wherein~~ where the path length is automatically controlled further based on the estimated phase error.

37. (Currently amended) The method of claim 35, ~~wherein~~ where estimating the phase error comprises:

performing a least squares estimation of the phase error using the determined probabilities.

38. (Currently amended) The method of claim 33, ~~wherein~~ where estimating the phase error comprises:

employing at least one Kalman filter to estimate the phase error.

39. (Currently amended) The method of claim 35, ~~wherein~~ where estimating the phase error comprises:

performing a robust least squares estimation of the phase error using the determined probabilities.

40. (Currently amended) The method of claim 39, ~~wherein~~ where the robust least squares estimation comprises at least one of least absolute residuals and Bisquare weights.

41. (Currently amended) A quantum cryptographic key distribution (QKD) endpoint, comprising:

a QKD receiver configured to:

receive symbols transmitted over a QKD path via quantum cryptographic mechanisms, and

distinguish training symbols from data symbols in the received symbols; and

a feedback system configured to control a length of the QKD path based on the received training symbols.

42. (Currently amended) The QKD endpoint of claim 41, ~~wherein~~ where the feedback system comprises a phase shifting element.

43. (Currently amended) The QKD endpoint of claim 42, ~~wherein~~ where the phase shifting element comprises a fiber stretcher.

44. (Currently amended) The QKD endpoint of claim 42, ~~wherein~~ where the phase shifting element comprises a phase modulator.

45. (Currently amended) The QKD endpoint of claim 41, ~~wherein~~ where the feedback system further comprises an estimation system, ~~wherein~~ where the estimation system is configured to:

estimate a phase error associated with the symbols transmitted over the QKD path based on the received symbols.

46. (Currently amended) The QKD endpoint of claim 45, ~~wherein~~ where the feedback system further comprises a training frame system, ~~wherein~~ where the training frame system is configured to:

determine probabilities of detection events associated with the symbols transmitted over the QKD path.

47. (Currently amended) The QKD endpoint of claim 46, ~~wherein~~ where the estimation system is further configured to:

estimate the phase error based on the determined probabilities.

48. (Currently amended) The QKD endpoint of claim 45, ~~wherein~~ where the estimation system comprises a least squares estimator.

49. (Currently amended) The QKD endpoint of claim 45, ~~wherein~~ where the estimation system comprises at least one Kalman filter.

50. (Currently amended) The QKD endpoint of claim 45, ~~wherein~~ where estimation system comprises a robust least squares estimator.

51. (Currently amended) QKD endpoint of claim 50, ~~wherein~~ where the robust least squares estimator employs at least one of least absolute residuals and Bisquare weights.

52. (Currently amended) A method of controlling a path length in a quantum cryptographic key distribution (QKD) system, comprising:

receiving one or more symbols that indicate that a subsequent sequence of symbols comprises training symbols;

determining probabilities associated with a plurality of detection events, the plurality of detection events being associated with ~~a sequence of~~ the training symbols received over a path in the QKD system via quantum cryptographic mechanisms; and

controlling a length of the path based on the determined probabilities.

53. (Currently amended) The method of claim 52, ~~wherein~~ where the probabilities comprise conditional probabilities.

54. (Currently amended) The method of claim 52, ~~wherein~~ where controlling the length of the path comprises:

estimating a phase error based on the determined probabilities.

55. (Currently amended) The method of claim 54, ~~wherein~~ where controlling the length of the path further comprises:

controlling the path length of the QKD path further based on the estimated phase error.

56. (Currently amended) The method of claim 54, ~~wherein~~ where estimating the phase error comprises:

performing a least squares estimation of the phase error using the determined probabilities.

57. (Currently amended) The method of claim 54, ~~wherein~~ where estimating the phase error comprises:

employing at least one Kalman filter to estimate the phase error.

58. (Currently amended) The method of claim 54, ~~wherein~~ where estimating the phase error comprises:

performing a robust least squares estimation of the phase error using the determined probabilities.

59. (Currently amended) The method of claim 58, ~~wherein~~ where the robust least squares estimation comprises at least one of least absolute residuals and Bisquare weights.

60. (Currently amended) A quantum cryptographic key distribution (QKD) endpoint, comprising:

a QKD receiver configured to:

receive a sequence of symbols transmitted over a QKD path via quantum cryptographic mechanisms, and

determine whether the sequence of symbols corresponds to a sequence of training symbols;

a phase shifting element disposed on the QKD path; and

processing logic configured to:

determine, based on determining that the sequence of symbols corresponds to a sequence of training symbols, conditional probabilities associated with a plurality of detection events, the plurality of detection events being associated with the sequence of symbols, and

adjust the phase shifting element to control a length of the QKD path based on the determined conditional probabilities.

61. (Currently amended) A computer-readable ~~medium~~ memory device containing instructions [[for]] configured to control ~~controlling~~ at least one processor to perform a method of controlling a path length in a quantum cryptographic key distribution (QKD) system, the method comprising:

receiving one or more symbols that indicate that a subsequent sequence of symbols comprises training symbols;

determining probabilities associated with a plurality of detection events, the plurality of detection events being associated with ~~a sequence of~~ the training symbols received over a path in the QKD system via quantum cryptographic mechanisms; and

controlling a length of the path based on the determined probabilities.

62. (Currently amended) A system [[for]] configured to control ~~controlling~~ a path length in a quantum cryptographic key distribution (QKD) system, comprising:

means for receiving one or more symbols that indicate that a subsequent sequence of symbols comprises training symbols;

means for determining probabilities associated with a plurality of detection events, the plurality of detection events being associated with ~~a sequence of~~ the training symbols received over a path in the QKD system via quantum cryptographic mechanisms; and

means for controlling a length of the path based on the determined probabilities.